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CKJ REVIEW

Tweet me: conferencing in the era of COVID-19 and 280 characters

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ABSTRACT

The European Renal Association – European Dialysis and Transplant Association (ERA-EDTA) Social Media (SoMe) Team provides Twitter coverage of the annual congress. During the coronavirus disease 2019 (COVID-19) pandemic, #ERAEDTA20 was the first major Nephrology congress to be delivered virtually. The effect of The SoMe Team and the consequences of the COVID-19 pandemic have not been explored previously. Tweets of the ERA-EDTA congresses 2016–20, using official hashtags, were evaluated. Metadata of each tweet were collected prospectively; original tweets, retweets and evidence-based tweets were identified. The gender of tweet author and location of Twitter activity were established. Network maps were created to ascertain the degree of polarization between the 2019 and 2020 Twitter activity, using Gephi 0.9.2.

Between 2016 and 2019, the total number of tweets and the number of tweet authors increased, as did the proportion of female authors (20% versus 27%). In 2019, there were fewer multimedia and evidence-based tweets: 8% versus 20% in 2016. Globally, there were fewer Nephrology conferences in 2020 and the number of tweets per day reduced by 53% from 2019. In 2020, The ERA-EDTA congress saw an increase in authors of 9% and only an 8% reduction in tweets. It was easier to disseminate information in 2020, measured by increased correlation coefficient (0.14 versus 0.12 in 2019). A higher proportion of countries was represented ($n = 55$ versus $n = 48$ in 2019) and a higher proportion of tweets came from women. In conclusion, the introduction of SoMe Team was associated with increased usage of Twitter and ease of information dissemination. Compared with #nephtwitter activity as a whole in 2020, SoMe Team has mitigated some of the pandemic's deleterious effects in scientific dissemination, relevant to Nephrology.

Keywords: congresses, COVID-19, online, social media, Twitter, virtual

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INTRODUCTION

Social media (SoMe): 'forms of media that allow people to communicate and share information using the internet or mobile phones…' [1]. SoMe is therefore always 'on' and by definition, it allows interaction among users. Early forms of SoMe probably originated in the late 20th century, but modern SoMe appeared relatively recently in the early 2000s and only really started to garner momentum with the launch of Facebook in 2004 [2, 3]. The SoMe platform Twitter launched in 2006 [4]. Users can post 'tweets' of up to 280 characters with the option to add images, videos and links to the text [5]. Worldwide, there are 340 million Twitter users and 500 million tweets are sent daily [6]. SoMe is a major player in modern medicine. Twitter, in particular, promotes education, research, rapid dissemination of information, networking, narrowing of the gap between healthcare workers and patients, and importantly, flattening of the hierarchy within healthcare [7, 8]. Of course, there are not inconsequential negative aspects to Twitter: accuracy concerns, trolling and bullying, breaches of patient confidentiality, incomplete information and gaps in research [8]. Perspectives can be polarized and the brevity of their nature can result in misinformation and misunderstanding. One way to mitigate this is to include links or images to support the information contained within the tweet. With the widespread use of SoMe platforms among physicians, the content of conference sessions can be shared in real time through tweets, Facebook posts or Instagram stories, for example [9]. Previous analyses of medical conferences show a trend towards a significant increase in both the number of tweets and of tweet authors in recent years, indicating that more subjects (doctors, nurses, medical or scientific societies, patients, patient organizations and pharmaceutical companies) are using the platform to participate in, change and influence, in real time, the process of a congress [9–11]. Importantly, both 'in-person' and remote attendees of a meeting can follow the meeting and generate interaction.

Following the declaration, in March 2020, of a coronavirus disease 2019 (COVID-19) pandemic, national lockdowns and travel bans occurred rapidly throughout the world. There has been a significantly increased reliance upon online technology to facilitate virtually everything from shopping to disseminating knowledge at a local, national and international level. SoMe use has become a virtual substitute: one where mask wearing is not necessary, and it is still possible to engage with friends and family. While the COVID-19 pandemic has highlighted the value of SoMe, nonetheless, data showing this impact are missing [12].

The ERA-EDTA, rather than cancel its 57th annual congress in June 2020, rapidly converted to a fully virtual meeting—the first of the major Nephrology congresses to do so. It promoted inclusivity as well as being family and environmentally friendly [13]. The ERA-EDTA SoMe Team, created in 2017, played a pivotal role in disseminating information and maintaining interest, interaction and ultimately science magic, armed only with a hashtag, #eraedta20.

The evolution of the ERA-EDTA SoMe Team

In 2014, ERA-EDTA created its first specific hashtag for the annual ERA-EDTA congress, #eraedta14. The society did not organize formal Twitter coverage until 2017 with the creation of a SoMe task force. Guidelines were published on the ERA-EDTA website detailing the etiquette expected for all SoMe interactions with @eraedta [14]. The inaugural SoMe Team, the 'nefro-tuiteros' compromised nephrologists from Spain, most of whom were involved in the Twitter coverage of the annual Spanish congress of nephrology in 2016.

In 2018, the team was expanded to include members from other countries and in 2019, for the first time, there was a formal application process (Table 1). The main role of the team was to provide broad Twitter coverage of the annual ERA-EDTA congress using the @eraedta account. Subsequently, the role has expanded and new initiatives have been introduced including selection of the best posters by the SoMe Team, interviews with poster prize winners and tweetorials published using the hashtag, #tweetorialERA.

In this article, we reflect upon Twitter usage at ERA-EDTA congresses since 2016 with particular focus on effects following the introduction of the SoMe Team in 2017 and the consequences of the COVID-19 pandemic on the #Nephtwitter community.

MATERIALS AND METHODS

The publicly available tweets of the ERA-EDTA online meetings 2016–20 were evaluated. These are identified via the hashtags: #eraedta2016, #eraedta17, #eraedta18, #eraedta19 and #eraedta20 (not case sensitive) and are collectively referred to as '#eraedta'. These are the official hashtags established by the ERA-EDTA. Metadata of each tweet was collected prospectively, with the start and end dates for each year's data collection defined by the meeting duration of the ERA-EDTA annual congress.

The type of metadata analysed for each tweet was structural, descriptive or both [15]. Both structural and descriptive metadata were collected in its native format—JavaScript Object Notation (JSON). JSON is a structured computer language format that orders and compartmentalizes the information found in a tweet. Information such as author name, geolocation, tweet date, presence/absence of a tagged individual, citation URL, type of tweet (original or retweet) and/or multimedia [image(s) or video] are stored in the JSON file of each tweet. Evidence-based tweets are defined as those that contain a citation link to an external source or reference. Mutable and/or reader-generated data, such as the number of retweets, likes and/or replies that a particular tweet has earned, are not stored within the

Table 1. The changing composition of the ERA-EDTA SoMe Team from 2017 to 2020

SoMe Team	#eraedta17	#eraedta18	#eraedta19	#eraedta20
Total	7	10	17	19[a]
Female (%)	5 (71)	6 (60)	10 (59)	11 (58)
Nationality				
France				1
Greece			1	1
Ireland			1	1
Italy			1	1
Poland		1		
Portugal			1	1
Turkey		2	2	2
Spain	7	6	5	5
UK			4	5
Non-EU country		1[b]	2[c]	2[c]

[a]Of these 19, 3 are original 'nefro-tuiteros' and 1 joined in 2018. Others joined via application process in 2019–20.
[b]Mexico.
[c]Nepal and India.

metadata of a tweet and were not collected or analysed. An application program interface that prospectively collected metadata from the ERA-EDTA Twitter hashtags was coded and the metadata deposited into Microsoft Excel. Structural and descriptive metadata order and hierarchy were preserved during this transfer. Subsequently, Visual Basic for Applications (the coding framework for Excel) was used to parse each metadata item from its JSON source. Once parsed, metadata items were analysed in Excel.

An #eraedta author was defined as a Twitter user who tweeted content using the appropriate hashtag during the live ERA-EDTA meeting. To evaluate gender, tweet authors were categorized as male, female, organization or unclassified. Transgender or non-binary classification could not be ascertained. Each author profile was visited, and, where reported, personal website. Self-reported gender was recorded where gender-specific pronouns or gendered family roles (e.g. 'mom' or 'dad', or equivalent) were declared. Classification was also recorded where the gender by which the Twitter author identifies was personally known to a manuscript author. Known organizations and groups were classified as 'organization'. All other accounts, including those where self-reported gender was not known or declared, were categorized as 'unclassified'.

To establish the location of Twitter activity, the self-reported geographic location found in the metadata of each tweet was reported. Each tweet author can alter the settings to reveal or conceal their geographic location. Tweets from authors who chose to conceal their location were not analysed. For all visible authors, an algorithm was coded to translate latitude and longitude coordinates into a text-based location. The location (city, state and province) was manually coded into nation. MapBox and Tableau were used to graphically display the number of authors and tweets originating from each nation [16, 17].

A network map was created to ascertain the degree of polarization within and between the #eraedta19 and #eraedta20 communities. Both communities were formed peri-pandemic; the latter was the first 100% virtual conference while the former was the last 'standard' conference in relation to the COVID-19 pandemic. The Pew Research Center has identified six morphologies into which SoMe communities can spontaneously organize; each morphology has a degree of polarization that can inhibit the free transfer of scientific information [18]. To understand the degree to which the #eraedta19 and #eraedta20 communities were polarized, a network map of various sizes and shades of green of circles and lines was created. Circles represent each person within the community that either transmitted (source) or received (target) scientific information from another member of the community. Information regarding each source–target pair is found within the metadata of each tweet. The size and darkness of each circle represents their influence within the community. SoMe influence was calculated using the eigenvector centrality score [19]. Lines connect each source–target pair and represent the transfer of scientific information from one person to the other.

The #eraedta19 and #eraedta20 communities were laid out to show polarized groups and two measures were used to quantify the degree of polarization. The clustering coefficient ranges from zero to unity and quantifies how connected each member is with other members in the online community. Coefficients near unity represent a fully connected online community while coefficients near zero indicate a highly polarized community. The average pathway length calculates the average number of individuals that a message must pass through in order to reach any random person. The larger the average pathway length, the more difficult it is for an author to transmit information to a recipient. Large average pathway lengths indicate greater polarity within the community [19]. Network map and graph metrics were calculated using Gephi 0.9.2 [20].

RESULTS

Effect of ERA-EDTA SoMe Team

Between 2016 and 2019, the total number of tweets using the appropriate ERA-EDTA congress hashtag increased, with the biggest single increase seen between 2018 and 2019. Similarly, the number of tweet authors has also increased (Figure 1).

Considering only authors where the gender is known, as the number of authors has increased so too has the proportion of female authors, going from 34% ($n = 110$) of total male and female authors ($n = 320$) in 2016 to 38% ($n = 248$) (total male and female authors, $n = 652$) in 2019 (Figure 2A). The proportions of tweets from female and male authors has remained fairly consistent between 2016 and 2019 at 33% ($n = 1235$) versus 31% ($n = 2322$), and 47% (1768) versus 49% (3647), respectively (Figure 2B).

Tweet characteristics differ between 2016 and 2019, with significantly fewer multimedia (tweets enhanced with a weblink, a video or an image) and evidence-based (tweets containing a citation link to an external source or reference) tweets latterly. Just 8% ($n = 580$) of tweets in 2019 were evidence-based compared with 20% ($n = 742$) in 2016; 52% ($n = 1941$) of tweets in 2016 were re-tweets compared with 78% ($n = 5783$) in 2019 (Figure 3).

Effect of the COVID-19 pandemic

The COVID-19 pandemic has had a deleterious effect on Nephrology overall with dramatically lower numbers of conferences in 2020 (65% reduction) in comparison with the previous

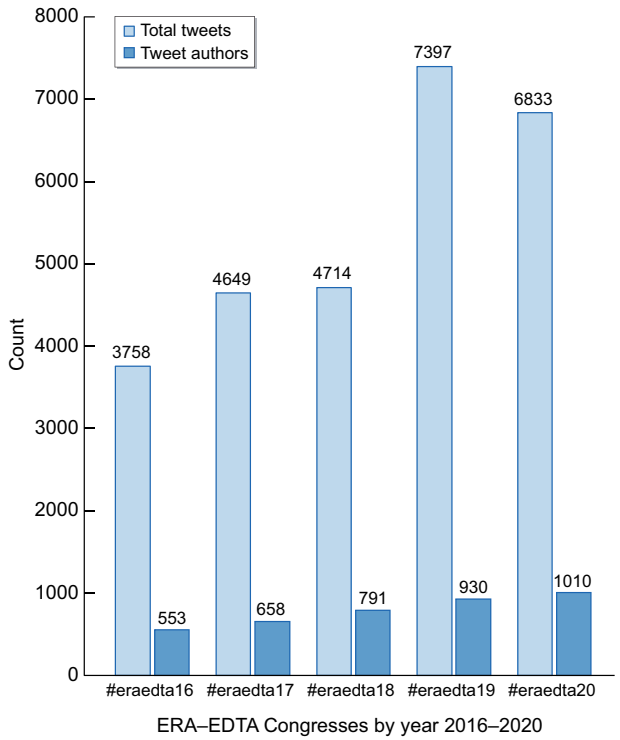

FIGURE 1: Total tweets and authors at ERA-EDTA congresses 2016–20.

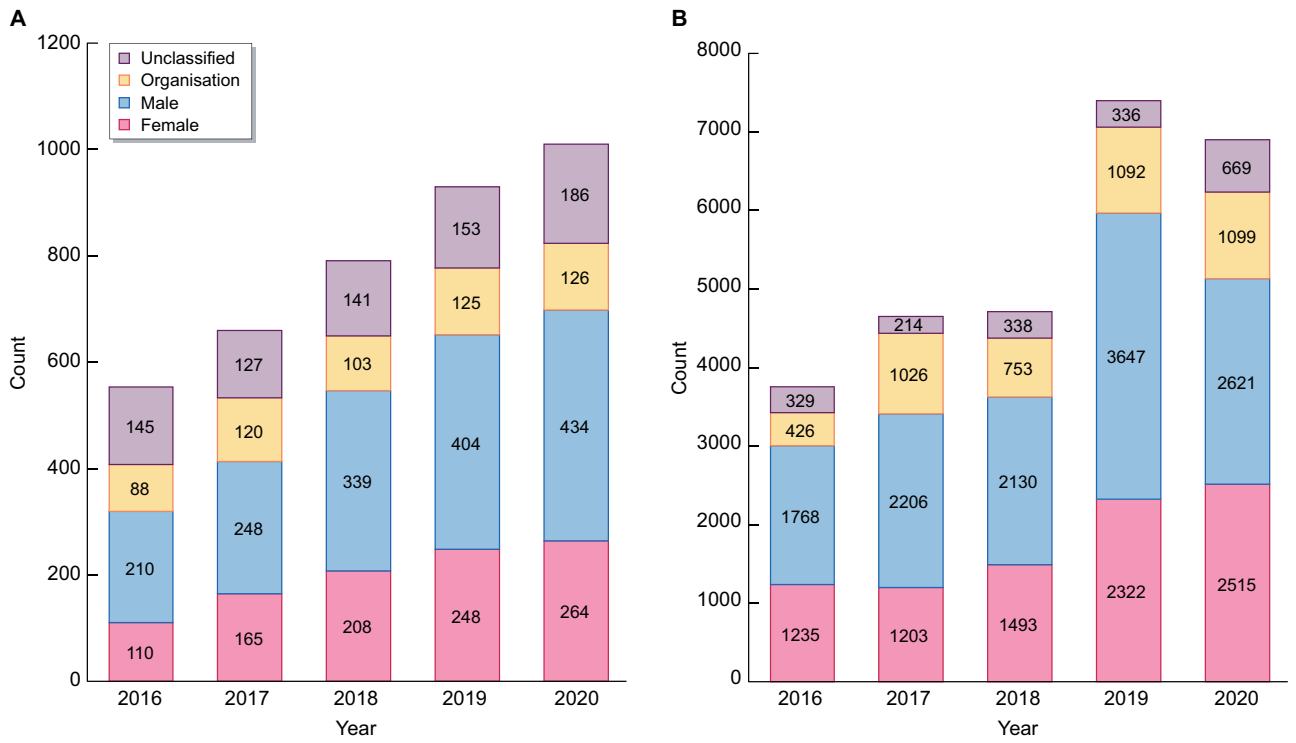

FIGURE 2: (**A**) Tweet authors, stratified by gender, at ERA-EDTA congresses 2016–20. (**B**) Tweets, stratified by gender, at ERA-EDTA congresses 2016–20.

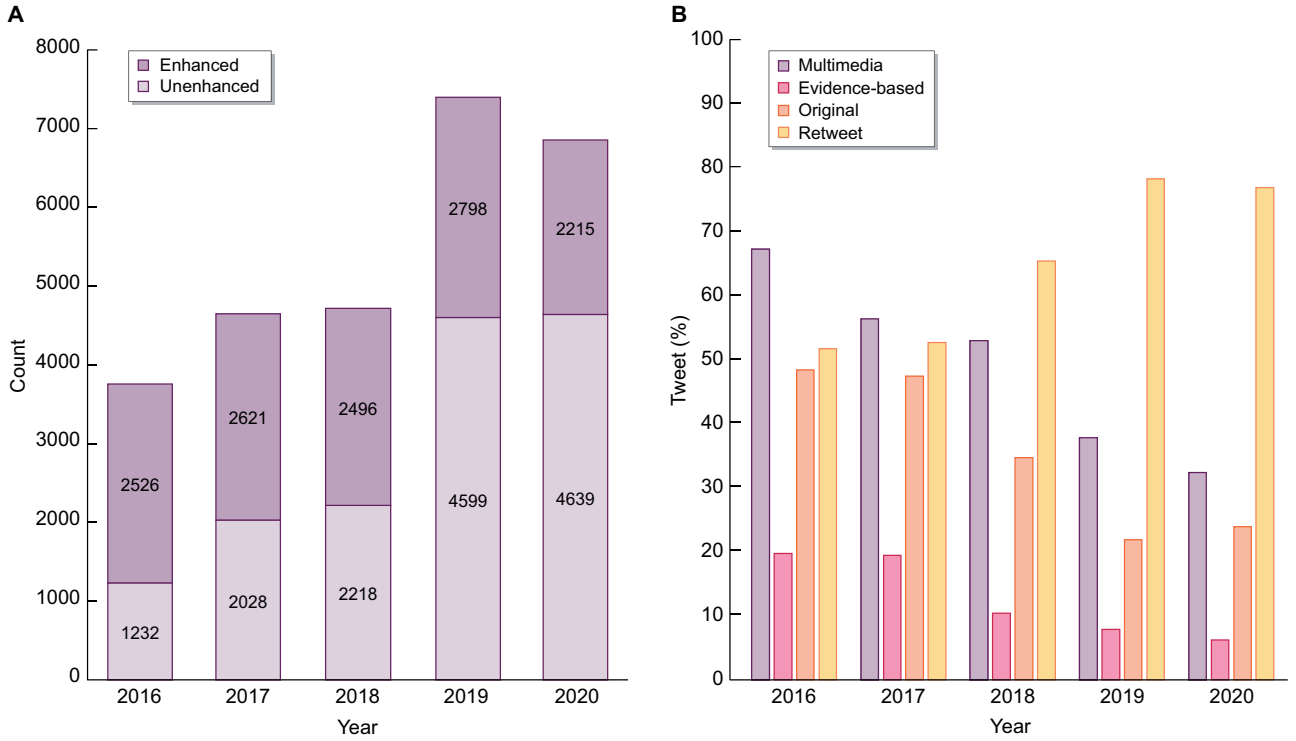

FIGURE 3: (**A**) Tweets, stratified by multimedia enhancement, at ERA-EDTA congresses 2016–20. (**B**) Percentage of multimedia, evidence-based and original tweets at ERA-EDTA congresses 2016–20.

year (Figure 4). The number of tweets per day has reduced by 53% between 2019 and 2020 and the number of tweets per author by 30% (Figure 5). The ERA-EDTA has mitigated the pandemic effects however, with an increase in authors at their 2020 congress from 2019 of 9% and only an 8% reduction in tweets (Figure 1). A higher number of tweets in 2020 came from female authors compared with in 2019 (8% increase) (Figure 2B).

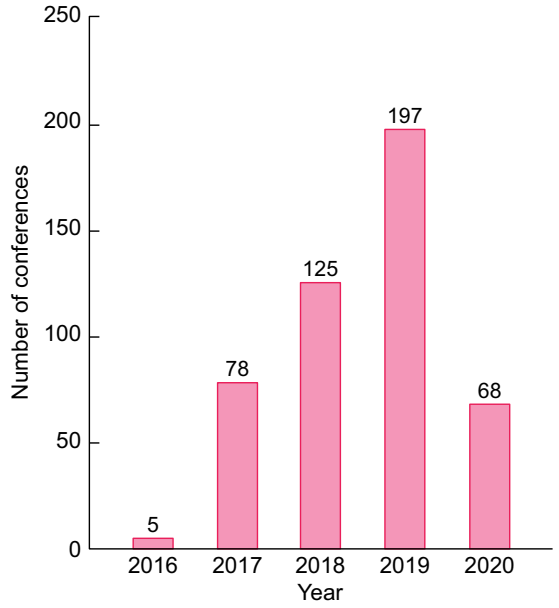

FIGURE 4: Number of conferences, each year, identified from #NephTwitter .

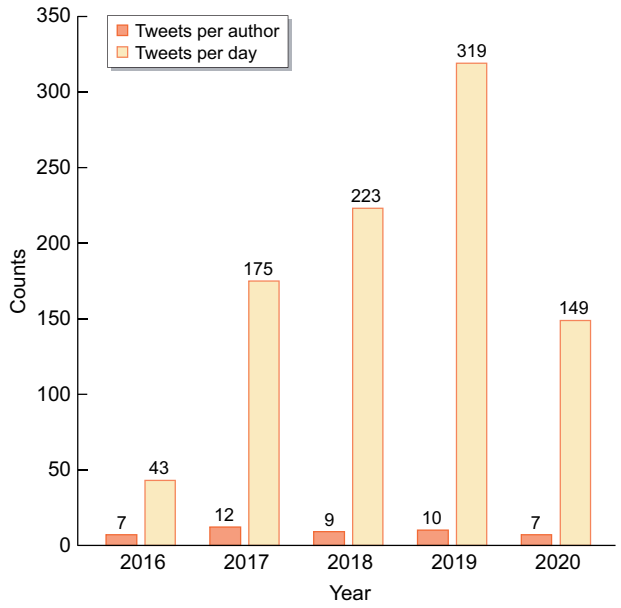

FIGURE 5: #NephTwitter data: the number of tweets per day and number of tweets per author, stratified by year.

Figure 6 shows that at the ERA-EDTA congress in 2020, it was also easier to disseminate information in comparison with the 2019 congress, measured by increased correlation coefficient (0.14 versus 0.12, respectively) and reduced pathway length (3.2 versus 3.4, respectively). The correlation coefficient ranges from 0 to 1, with figures closer to 1 indicative of better connection, and thus information can travel more easily. The greater the pathway length, the harder it is for information to reach a random unconnected target.

A higher proportion of countries was represented at the 2020 ERA-EDTA congress ($n = 55$) compared with the 2019 congress ($n = 48$), and of note these additional countries were outside Europe. The number of tweet authors was higher in India and the Americas in 2020 compared with 2019 ($n = 62$ in 2020 versus $n = 25$ in 2019, and $n = 212$ in 2020 versus $n = 168$ in 2019, respectively; Figure 7). Unsurprisingly, there were higher numbers of tweets from these continents too. In Europe despite a similar number of authors in 2019 and 2020, overall there were more tweets with a slightly different distribution. Fewer tweets came from Italian, French, Portuguese and Turkish authors in 2020, and significantly more from British, Spanish and Swedish authors (Figure 8).

Additionally, a higher proportion of tweets came from female authors than in previous years—36% ($n = 2515$) in 2020. The proportion of tweets attributable to male authors reduced from 49% ($n = 3647$) to 38% ($n = 2621$) in 2020 (Figure 2B).

DISCUSSION

Twitter coverage of the congresses pre-2020 was an adjunct to the in-person meeting. The ERA-EDTA SoMe Team was created to optimize this and to ensure broad representation of all sessions on Twitter. Following its inception, the increase in number of tweets and the increase in tweet authors using the appropriate #eraedta hashtag suggest that the team have had some impact in improving awareness and reach.

The team is deliberately inclusive, with women comprising almost 60% of members. Whilst it is encouraging to see an increase in the proportion of female authors from 20% in 2016 to 27% in 2019, male authorship has increased at a similar rate. There is no obligation to accurately record gender on Twitter; it stands, therefore, that accounts labelled as unclassified are from authors who identify as either male or female and skew the analysis. The same is true for organization tweets—the ERA-EDTA account is labelled as an organization; however, the majority of tweets from this account are from female authors (ERA-EDTA staff who run the account are all female and 60% of SoMe Team is female). Spain and the UK are over-represented on the SoMe Team simply because at inception, it was based upon nefro-tuiteros and subsequently led by nephrologists from these countries. In future, inclusivity of more countries, including outside Europe, will be important.

However, even with the addition of the SoMe Team, coverage was never designed to deliver an entire meeting to a worldwide audience but rather to signpost towards aspects of the congress that are of interest to an individual, potentially resulting in views of online slides or presentations or review of a published abstract or article. The argument can be made that this objective did not alter in 2020 but the way in which it was achieved did, because it had to.

Moving the congress to a fully virtual format was unanticipated and completely altered the way the congress was delivered, and whilst generally well-received was not without problem [13]. Twitter coverage should lend itself to this setting but it relies upon an individual tweeter possessing the ability to construct an effective tweet including multimedia, tagging authors and institutions, and reaching a wide audience. This is arguably more important when there is no in-person interaction. One advantage of Twitter is the ability to include multimedia, for example key slides from a presentation, and this is may be less straightforward online compared with in-person. Similarly, sharing live science from an online event is also not yet the norm and thus where tweeting may have occurred in person, it may be less likely to occur virtually, simply because we are not used to doing it. Some multimedia tweets at

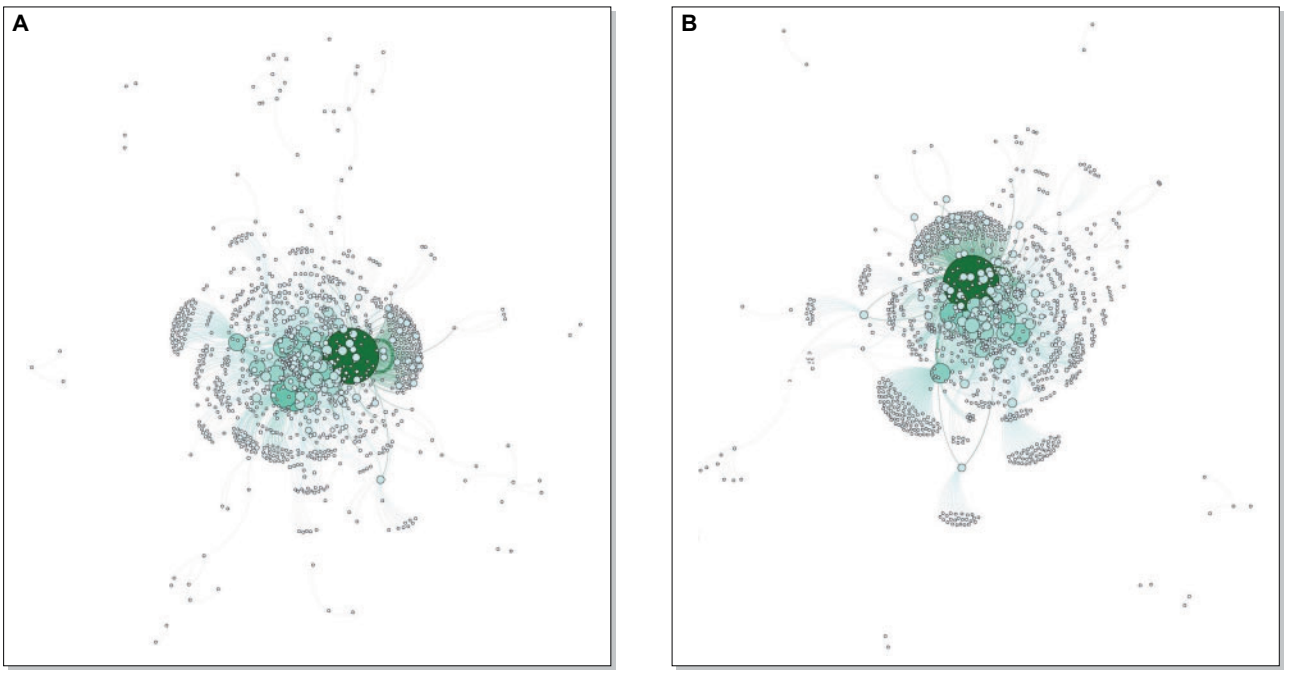

FIGURE 6: Network map for (**A**) #eraedta19 and (**B**) #eraedta20. The large green circle represents ERA-EDTA. In 2019, the correlation coefficient was 0.12 versus 0.14 in 2020, and the pathway length 3.4 versus 3.2, respectively. The correlation coefficient ranges from 0 to 1, with figures closer to 1 indicative of better connection, and thus information can travel more easily. The greater the pathway length, the harder it is for information to reach a random unconnected target.

congresses will, of course, not be academic, but will be social and often relate to the conference city. Although these are not educational, they are an important function of the congress and help to build the Nephrology community. Obviously, that cannot happen virtually. This is the first study to look at the impact of COVID-19 on the #nephtwitter community.

Overall, COVID-19 has had a deleterious effect on Nephrology with significant reductions in the numbers of congresses, the number of tweets/day and the number of tweets/author. That #eraedta20 mitigated these effects with increased authors (9%) and only a small reduction in tweets (8%) is likely attributable to it being the first big Nephrology congress to hold a fully virtual event. As the pandemic has continued, there is undoubtedly 'online' apathy; face to face interaction is missed and the novelty has worn off, almost certainly leading to lower levels of engagement [21].

It was easier for information to be disseminated via Twitter in 2020. If we consider ERA-EDTA, represented by the large blob in the centre of Figure 6, to be the mainstream of knowledge and the central conversation, then the smaller blobs are groups of tweeters who are having a 'conversation' with each other that may be of interest to others who are not immediate party to the conversation. In 2020, it was easier to overhear that conversation and thus to obtain the information. Why? Possible explanations include that there were more tweet authors, perhaps because of the novelty aspect of a virtual congress. There was also a larger representation from more countries than previously, notably India and the Americas, presumably because the virtual environment makes it easier to 'attend' and engage from a different time zone.

A virtual congress may encourage people to join SoMe platforms including Twitter to stay abreast of developments [22]. However, many may opt to 'lurk', absorbing the information but not passing it on or composing original tweets. This is one of the advantages of the platform; obtaining information without the need for engagement. Additionally, those less practiced or experienced may omit the appropriate hashtag or use the incorrect hashtag. While these tweets may be picked up by the #nephtwitter community and circulated, they will not be identified in our analysis.

Gender equality remains a sensitive issue. On Twitter, despite a higher proportion of tweets from female authors in 2020, women do continue to appear to be under-represented. There are several postulated explanations including that not all tweet authors are identifiable as male or female and thus cannot be categorized. There has been much made of feeling less intimidated in the online environment [23]. That, however, applies to both men and women. It may be that women are more inclined to use other platforms, e.g. Instagram or Facebook, and that was outside the scope of this analysis. It is easy to say that women feel less intimidated in an online environment and there is no doubt that this is true for some, but to consider this as the only explanation is to portray women unfairly. Women may be more likely to 'lurk'. It is difficult to pass definitive comment on gender equality without knowing the numbers of male and female participants, and this information is not accurately available. Ultimately, the number of tweets does not necessarily translate to the useful passage of information and at present markers of influence and the 'quality' of a tweet are subjective and inherently difficult to assess objectively. There is therefore no accurate data effectively comparing the quality of a tweet from an individual author. It is plausible that a few tweets from female authors may be of higher educational value than many tweets from male authors or vice versa. Currently, there is no mechanism to accurately assess this.

In the virtual era, an evidence-based or multimedia tweet is likely to be the most information dense and this type of tweet

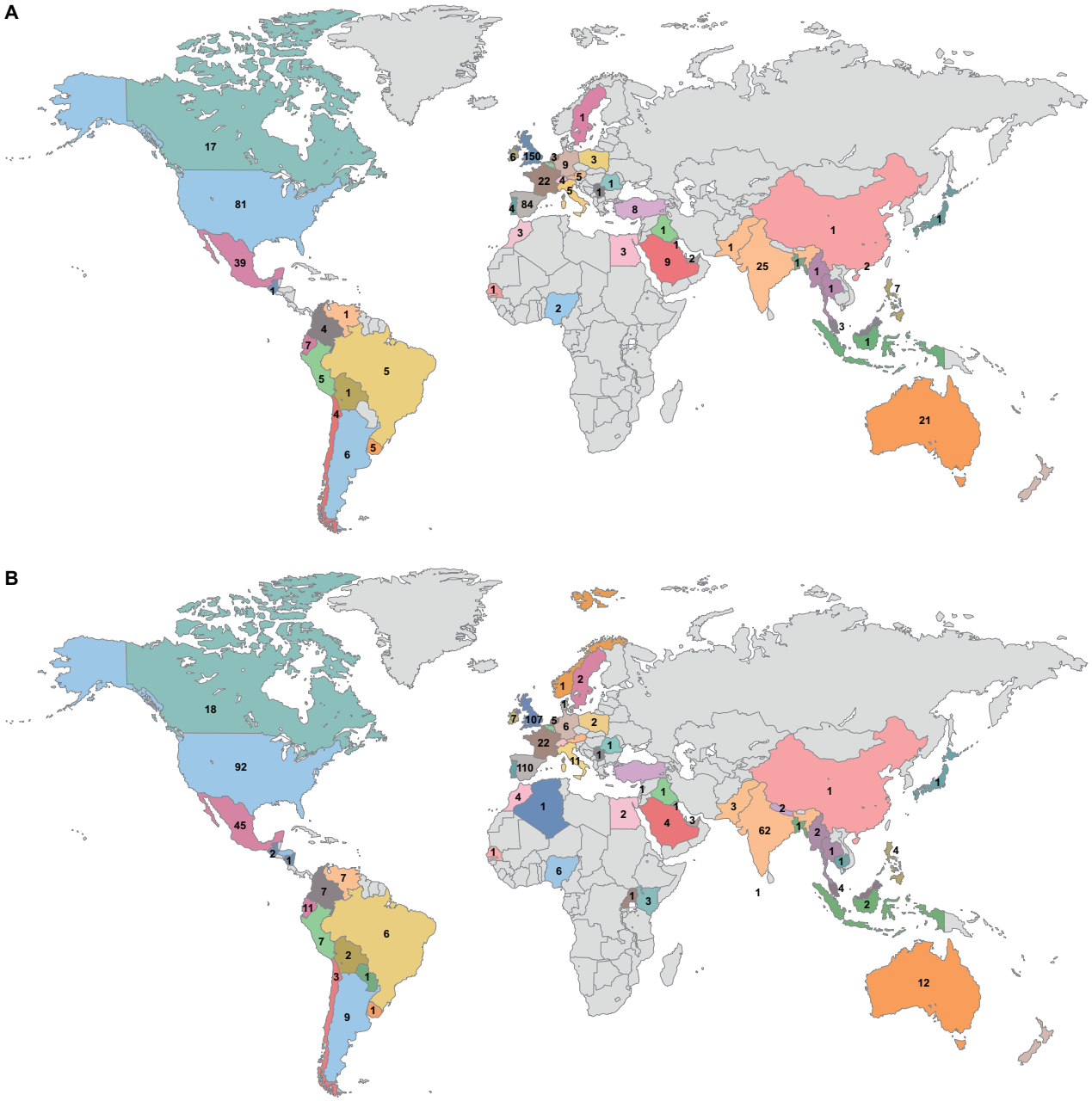

FIGURE 7: Number of tweet authors, by country, for #eraedta19 (**A**) and #eraedta20 (**B**).

should be encouraged at a congress to improve the reach of information. Retweets are much more common in 2019 and 2020, comprising around 75% of all tweets including the appropriate #eraedta hashtag. It is likely that many of these tweets will include multimedia—and should therefore be informative. However, they are not part of Twitter metadata because they can be altered by the author who retweets, and thus are not included as an original multimedia tweet. This is important because retweets extend reach by their nature and so will often provide education and information to a new target. Indeed, a retweet may be better than the original tweet; if, for example, it includes additional information, e.g. a new weblink or an image.

The virtual nature of the #eraedta20 congress and that it was freely available online means that there will be a proportion of people who did not watch it live and may then opt not to tweet at a later date. Furthermore, there will be viewings of presentations at a later date on the basis of a tweet that has piqued interest. We cannot measure this. It would, however, be possible to analyse to see where web traffic was driven from and to ascertain from what source it was driven.

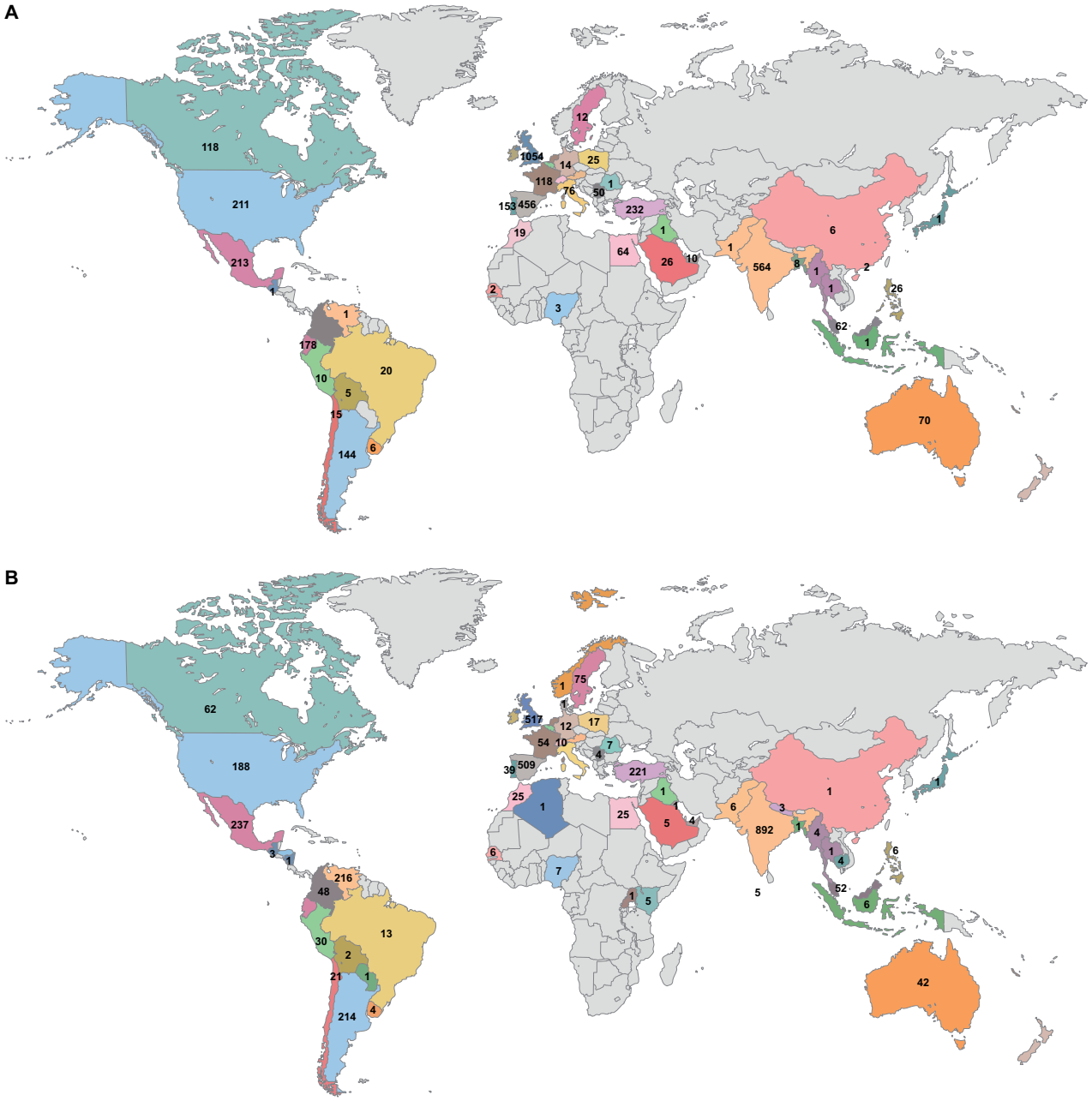

FIGURE 8: Number of tweets, by country, for #eraedta19 (**A**) and #eraedta20 (**B**).

CONCLUSION

Twitter is designed to allow rapid dissemination of information in real time to a global audience; an attribute which should lend itself to the COVID-19 virtual world. To optimize value at congresses and to mitigate online apathy, tweets should be as informative as possible by including multimedia such as weblinks and images, and engagement should be maximized to allow for meaningful online interaction. For the ERA-EDTA, diversifying the SoMe Team, with increased representation from different countries, is likely to be beneficial. Perhaps most importantly in the virtual world, Twitter must be utilized for the purposes of engaging congress attendees; examples could include a dedicated Twitter takeover from an invited speaker or from an abstract presenter, and dedicated signposting to aspects of the congress that may be less publicized, e.g. poster presentations.

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Lees, Leyre Martin, Maria Quero, Sourabh Sharma, Sinead Stoneman, Sokratis Stoumpos and Didem Turgot.

CONFLICT OF INTEREST STATEMENT

K.I.S. is a member of the ERA-EDTA SoMe Team and is on the ERA-EDTA Council. E.M., H.D., K.G., D.G. and N.M. are all members of the ERA-EDTA SoMe Team. M.J.S. is on the ERA-EDTA Council. T.D. is the creator of NOD Analytics.

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